

ACCESSION #: 9708200013

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Harris Nuclear Plant Unit-1 PAGE: 1 OF 3

DOCKET NUMBER: 05000400

TITLE: Manual reactor trip due to loss of Normal Service Water

EVENT DATE: 9/03/96 LER #: 96-018-01 REPORT DATE: 8/08/97

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

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Licensing

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: KG COMPONENT: P MANUFACTURER: P115

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 3, 1996 at approximately 2338 hours, with the plant operating in mode 1 at 100% power and the "B" Normal Service Water (NSW) pump in service, operators in the main control room received numerous NSW system alarms and observed indication of zero flow and pressure in the NSW header. The Reactor Operator manually started the standby "A" NSW pump to restore flow, but the pump tripped after running for less than two minutes. When re-start attempts on the "A" NSW pump failed, a manual reactor trip was initiated at approximately 2342 hours. Plant systems responded as expected,

including an automatic start of the Auxiliary Feedwater System and the unit was stabilized in mode 3 (Hot Standby).

The cause of this event was a mechanical failure of the "B" NSW pump and the failure of the "A" NSW to remain running once manually started. The "B" NSW pump shaft sheared.

Additional investigation was subsequently completed to determine the cause of the "A" NSW pump trip. This investigation revealed that the torque switch on the pump's discharge valve (1SW-289) was actuating and this was preventing the valve from opening to the 10% open position, which is required for pump operation.

Corrective actions included restoring the "A" NSW pump to service, performing a secondary plant walkdown to support plant re-start and evaluating the acceptability of having only one NSW pump available during plant operation while repairs continued on the "B" NSW pump. Subsequent actions included restoring the "B" NSW pump, completing the failure analysis for the "B" NSW pump sheared shaft, and completing the additional investigation into the "A" NSW pump trip that resulted in this LER revision.

This event is reportable per 10CFR50.72 and 10CFR50.73. A 4-hour non-emergency report was made to the NRC at approximately 0207 via the emergency notification system.

TEXT PAGE 2 OF 3  
TEXT PAGE 2 OF 3

#### EVENT DESCRIPTION:

On September 3, 1996 at approximately 2338 hours, with the plant operating in mode 1 at 100% power and the "B" Normal Service Water pump (NSW, EHS Code: KG-P) in service, operators in the main control room received numerous NSW system alarms and observed indication of zero flow and pressure in the NSW header. The Reactor Operator manually started the standby "A" NSW pump to restore service water flow. After observing closed indication for the "A" NSW pump breaker and indication that the "A" NSW pump discharge valve was opening, the "B" NSW pump was secured to allow the "B" discharge valve to shut. At this time, the Reactor

Operator noticed that the "A" NSW pump had tripped. Following two unsuccessful re-start attempts on the "A" NSW pump, the Unit-Senior Control Operator directed a manual reactor and turbine trip at approximately 2342 hours. Prior to the reactor trip, the "A" Emergency Service Water (ESW) pump automatically started due to low header pressure. Plant systems responded to the reactor trip signal as expected, including an automatic start of the Auxiliary Feedwater System (EHS Code: BA) on steam generator low-low level due to Reactor Coolant System (RCS, EHS Code: AB) shrink following the reactor trip. The unit was stabilized in mode 3 with RCS temperature at 557 degrees and pressure at 2235 psig.

Following investigation and repairs, the plant was restarted on September 9, 1996 and returned to the grid at approximately 0342 on September 10, 1996. Delays were encountered in plant re-start due to the passage of Hurricane Fran (reference LER 96-019). Since the forced outage exceeded 72 hours, hot rod drop testing was performed prior to reactor startup in accordance with Harris Plant's response to NRC Bulletin 96-01. Reference Attachment 1 for hot rod drop testing results.

This event is reportable per 10CFR50.72 and 10CFR50.73 as a Reactor Protection System actuation. A 4-hour non-emergency report was made to the NRC at approximately 0207 via the emergency notification system.

**CAUSE:**

The cause of this event was a mechanical failure in the "B" NSW pump and

a malfunction resulting in the "A" NSW pump tripping after being manually started. The "B" NSW pump experienced a sheared pump shaft. A metallurgical analysis determined the most probable cause to be a bent pump shaft due to alignment problems, which caused the bronze bearings to heat up and fail resulting in the sheared pump shaft.

Additional investigation was subsequently completed to determine the cause of the "A" NSW pump trip. This investigation revealed that the torque switch on the pump's discharge valve (1SW-289) was actuating when high D/P conditions exist across the valve and this was preventing the valve from opening to the 10% open position, which is required for pump operation. These high D/P conditions are present when the standby NSW pump starts with the other NSW pump not running, as in the case of the "B" NSW pump trip.

#### SAFETY SIGNIFICANCE:

There were no safety consequences as a result of this event. The manual reactor/turbine trip was initiated per plant operating procedures to protect secondary plant components following the loss of Normal Service Water. Plant systems responded as expected following the initiation of the manual reactor/turbine trip.

TEXT PAGE 3 OF 3

#### PREVIOUS SIMILAR EVENTS:

Previous similar problems with the NSW pumps and discharge valves were experienced during the reactor/turbine trip that occurred on April 25,

1996, which was reported in LER 96-008. Corrective actions for that event included adjusting the mechanical latch mechanism on the "A" NSW pump discharge valve control relay (CR1/2189) to ensure that it "latched in" properly and replacing two of the "B" NSW pump discharge valve control relays (CR4/2190 & CR1/2190) that experienced intermittent failures. Based on indications observed during the September 3, 1996 loss of NSW event, these corrective actions were effective since their associated functions performed as required. LER 96-008 also contained a corrective action to perform additional NSW testing during the next refueling outage (RFO-7). This testing was performed and the results will be included in a revision to LER 96-008.

#### CORRECTIVE ACTIONS COMPLETED:

1. Trouble shooting was performed which determined that a common-mode failure mechanism did not exist with the NSW pumps.
2. The "A" NSW pump was returned to service on September 7, 1996.
3. A safety analysis was performed on September 5, 1996, which determined the acceptability of returning the plant to service with only one NSW pump available while repairs continued on the "B" NSW pump. This analysis, combined with the results of an engineering evaluation, concluded that repairs to the "B" NSW pump could be made on-line with the "A" NSW pump in service.
4. A secondary plant walkdown to assess potential damage related to the loss of NSW transient was completed on September 4, 1996.

Discrepancies identified during the walkdown that would prevent plant re-start were repaired on September 4, 1996.

5. Repairs were completed and the "B" NSW pump was returned to service on October 29, 1996.

6. Additional analysis was performed to determine the failure mechanism involved in the "B" NSW pump sheared shaft and the results are provided above in the cause section. This analysis was completed on November 15, 1996.

7. Additional testing and evaluation was performed to determine the cause of the "A" NSW pump trip after being manually started on September 3, 1996. The results are described above in the cause section. Follow-up actions to address the torque switch issue include; (1) A new discharge valve (1SW-289) was installed to improve the disc seating area and require less torque to open the valve, (2) The orientation of the valve was changed, which will result in less torque required to open the valve during high D/P conditions, (3) The stop limit switches were re-set such that the valve actuator does not drive the disc as far into the valve seat. This will also result in the need for less torque to open the valve.

These actions were completed on May 7, 1997.

8. Training on the lessons learned from the loss of NSW event was incorporated into the operator training program and was covered during Licensed Operator Re-qualification session #6. This was

completed on November 14, 1996.

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